PERMUTATIONS & COMBINATIONS

1)Counting

1.1 Basics of Counting_tut_ per_com:

Introduction:
Permutations and combinations were the concepts introduced in mathematics just as mathematical tools to assist counting. Everyday we do so many activities that requires counting. In this section we will juts introduce some problems which can be solved merely by counting and also see why there was a need for Permuatations and Combinations.

e.g. Consider a seller of colors in a small scale. He buys three colors Blue, Green , Blackand Red. Now he mixes two colors at a time and sells them . How many colors does he sell?
Solution : He can form the sets of 2 in the following ways : (Blue,Green), (Blue,Black), (Blue,Red),(Green,Black),(Green,Red),(Black,Red). All these combinations will form a new color and so he is selling 6 colors in all.

But imagine a large company whicg buys plenty of colors, mixes them and sells them.Such companies cannot do all the counting to find out how many products they are selling.They need a mathematical tool to solve their problems.

1.2 Addition Rule_tut_per_com:

Definition:
Principal of addition : If two events E_1 and E_2 can occur independently in m and n ways respectively, then either of the two events can occur in (m+n)ways.

e.g. If a person has the option of going to his job by walking, cycling, scooter , tempo , bus and car.
If it is asked that in how many different ways can he go for his job. The answer will be 6 ways, the addition of all these modes of transport.

1.3 Multiplication Rule_tut_per_com:

Definition
Principal of multiplication: If an event can occur in m different ways, following which another event can occur in n different ways, then the total number of occurence of the events in the order given is m*n.

e.g. There are 5 roads from town A to B and 6 roads from town B to C. In how many ways can a person go from town A to town C?

Solution : This is a direct application to the principal of counting. The person can choose a road from
A to B in 5 ways and corresponding to each road taken there are 6 other roads from B to C.So the total number of ways = 5*6= 30 ways.

e.g Suppose there are 4 boys and 3 girls in a class , how many ways can a couple be formed?

Solution: This also a direct application of the first principal of counting. The number of ways of choosing a boy is 4 and to each selected boy we can choose a girl in 3 ways. So it is a case of choosing a boy in 4 ways and a girl in 3 ways. So the total number of favourable ways =4*3=12.

We can also see the 12 combinations . Suppose we number the boys as B1,B2,B3,B4 and the girls as G1,G2,G3.
The twelve pairs are :
B1G1, B1G2,B1G3
B2G1, B2G2,B2G3
B3G1,B3G2, B3G3
B4G1,B4G2,B4G3

e.g. There are 10 questions in an examination and each question has 4 choices, in how many different ways can one answer the questions?

Solution: This is also an application to the principal of counting.Suppose we choose a question , to every question picked there are 4 choices of answering the question, either A,B,C,D. So for each question there are 4 ways and again to the next one there will be 4 ways. So in total there will be
4*4*4*4*.........10 times.
So the required number of ways is $4^{10.}$

e.g. How many different ways can one form a 4 digit number using the numbers 1-9 with repetition?

Solution : Consider any digit it can be filled in 9 ways and again go to the next digit , it can also be filled in 9 ways. So the number of ways of filling each digit is 9.
So the total number of cases 9*9*9*9= 9^{4}

1.4 Difference between AND and OR_tut_per_com:

Introduction:
The thumb rule is that whenever the statement OR occurs in a problem there is an **addition** among the cases. Whenever the statement AND occurs there us a **multiplication** among the cases.

Mostly the addition is to be done when there are two events which do not take place simultaneously, there is always a choice to be made among the two : either this **or** that.

You will be required to do multiplication in most of the cases and these problems will be such that they will occur simultaneously.

e.g. Suppose that there are 20 students in a class having 5 girls and 15 boys.
a)In how many ways can a head be chosen where the head can be either a boy or a girl?
b)In how many wats can a head girl and a headboy be chosen?

Solution:
a)Note the OR in this problem. We have to choose a head which can be either a girl or a boy . So we can choose a girl out of 5 girls (total ways is 5) or a boy out of 15 boys(15

ways). So the total number of ways is 5+15=20

b)Note the word AND in the problem. We have to choose a head girl and also a headboy.Choosing one headgirl(5 ways) and choosing one headboy(15) ways. Sice both the events have to take place simultaneously so there will be a multiplication between the events.So tatal number of ways= 5*15=75

Quiz - 1

1.A Filmstar has 20 pairs of shoes and 40 socks , in how many ways can he wear a shoes and socks on a particular day ?

A) 600 B)800 C) 1200 D) 650

2. A person has 5 travelling bag , 3 camera and 2 pocket knives. In how many ways can he travel if he carries one of each type?

A)30 B)24 C)60 D)36

3.A multiple choice test consists of 15 questions and if each of these questions has 5 choices , in how many ways can a student answer the questions if he attempts all the questions?

A)5^{15} B)15^{5} C)10^{12} D)6^{12}

4.In how many ways can a person send invitation cards to 6 of his friends if he has 4 servants to distribute the cards ?

A)4^{7} B) 4^{6} C) 6^{4} D)6^{7}

2)Permutations and combinations:

2.1 Factorial_tut_per_com:

The notation n! represents the product of first n natural numbers, i.e., the product 1 × 2 × 3 × . . . × (n – 1) × n is denoted as n!. We read this symbol as 'n factorial'. Thus, 1 × 2 × 3 × 4 . . . × (n – 1) × n = n !

e.g. Calculate 5!= 5*4*3*2*1= 120

2.2 Permutations_tut_per_com:

Definition:
A permutation is an arrangement in a definite order of a number of objects taken some or all at a time.
The number of permutations of n different objects taken r at a time, where $0 < r \le n$ and the objects do not repeat is $n(n-1)(n-2)\ldots(n-r+1)$, which is denoted by ^nP_r.

$^nPr= n!/(n-r)!$
Introduction:

Whenever we talk about arrangements and distribution it means we have to use permutations.We use permutations whereever the order of things is important.

e.g. In how many ways can 5 different things be distributed among 5 people ?

Solution: The word distribution shows that we have to use permutations. It is nothing but the permutations of 5 things taken 5 at a time so $^5P_5$.

e.g. In how many ways can 5 children be picked out of 15 and arranged in a line.

Solution: Note again the key word arrangement. This word shows that we have to use permutations. This is nothing but the permutations of 15 things taken 5 at a time so $^{15}P_5$

2.3 Combinations_tut_per_com:

Definition:

Combination is nothing but selecting few or all of the objects from a given set of objects.
The formula for finding the number of combinations of *n* different objects taken *r* at a time, denoted by *n*C*r*..

^nC_r= n!/(n-r)!*r!

Introduction:

Whenever we come across the words selecting , grouping etc , where the order of things is not that important then we are dealing with combinations.

e.g. In how many ways can one select 5 diffrent balls out of a box containing 15 different balls.

Solution:Note the word select, it indicates that we have to use combinations. This is nothing but the combination of 15 things taken 5 at a time so $^{15}C_5$

e.g. Suppose that a bag contains 10 red balls and 15 green balls. In how many ways can a group of 5 red and 5 green be made.

Solution: Note the word group, this implies that we are dealing with combination here.Also as we had discussed earlier, note the word "and", this denotes that we have to simultaneously select red and green balls so there must be a multiplication between the two. Choosing 5 red balls in $^{10}C_5$ ways and choosing 5 green balls in $^{15}C_5$ ways and so the total no of ways is $^{10}C_5$* $^{15}C_5$

2.4 Understanding the differencce between permutations & combination_tut_per_com:

Suppose there are 4 boys B1 B2 B3 and B4 .
a) In how many ways can groups of 2 be formed ?
Solution
We will solve this problem first by simple counting.
There are six groups possible namely as B1B2, B1B3, B1B4, B2B3, B2B4, B3B4
Essentially we have selected groups of 2 out of 4. This selection procedure is called as combination and is denoted by $^4C_{2.}$

Now if we choose one such group, suppose B1B2 , while selecting a group of these two the arrangement does not matter in whatever way they occur they form a group. But if we make them seat on 2 seats the arrangement comes into picture. They can be seated in two ways B1B2 or B2B1.
Selection and arrangement together is known as permutations.
b)So if the problem says that in how many ways can groups of 2 be arranged out of 4 Boys?
The ans : ${}^{4}P_{2}$= 12 ways. [Selection was done in 6 ways and each such selected can be arranged in 2 ways. So total 12 ways.]

"Selecting is known as Combination and and selecting and arranging together is known as Permutation"

e.g.
a)Find the number of ways of in which 4 Boys can be selected out of a class having 12 Boys?
b)In how many ways can they be selected and numbered from 1-4 ?

Solution:
a) This is a problem of combinations where you have to select 4 out of 12 , so the correct answer = ${}^{12}C_{4}$
b) Selecting 4 boys and then numbering them as 1,2,3,4 involves selecting 4 out of 12 and then arranging them . So it is problem of arrangement and the answer is ${}^{12}P_{4}$.

e.g. In how many ways can 5 movie tickets be distributed to 5 people if the tickets are numbered.

Solution: See when the first person comes there are 5 options of giving the ticket , any of the 5 tickets can be given to him. For the next person there are 4 ways to give the tickets and then for the third we have 3 ways, for 4 th we have 2 ways and 5 th we have 1 way. Now these ways can occur together in any way so the total number of ways=5*4*3*2*1=120 ways.

This could be directly done using the permutation formula because the problem here is the arrngement of 5 tickets out of 5 so the solutin is ${}^{5}P_{5}$= 5!/0! = 5!= 120[Note that 0!=1]

e.g. How many 5 digit numbers can be formed using the digits 2,3,4,5,6 if the repitition is not allowed?

Solution: If we consider 5 digits of a number. The first digit can be filled in 5 ways, as the repitition is not allowed so the second digit can be filled in 4 ways, the next in 3 ways, the next in 2 ways and the last one in 1 way. Now any number can come in any place and all these events occur togehter so total number of ways is 5*4*3*2*1.

This can be directly using the permutations formula because froming a 5 digit number out of these 5 numbers is nothing but arrangement of these 5 numbers taken all at a time. So the solution is ${}^{5}P_{5}$= 5!/0! = 5!= 120[Note that 0!=1]

e.g.There are 50 students in a class, having 30 girls and 20 boys. In how many ways can one boy and one girl be chosen among these?

Solution: Choosing a girl out of 30 has 30 possibilities because there are 30 girls in the class. Similarly choosing a boy out of 20 boys can also be done in 20 ways. As choosing the boy and the girl occurs togehter so total number of ways is 30*20=600 ways.

This can be done directly using the combination formula. Here we are selecting and making a selection means combination.
No of ways of selecting a girl out of 30 girls is $^{30}C_1$
No. of ways of selecting a boy out of 20 boys is $^{20}C_1$
So the total number of ways= $^{30}C_1 * ^{20}C_1$=600 ways.
e.g. Suppose there are 8 consonants and 5 vowels.
a)In how many ways can one choose 4 consonants and 2 vowels.
b)In how many ways can these 4 consonants and 2 vowels be arranged to form a word?

Solution:
a) Number of ways of choosing 4 consonants out of 8 is $^{8}C_4$ and the number of ways of choosing 2 vowels out of 5 is $^{5}C_2$. So the number of ways of choosing the consonants and vowels together is $^{8}C_4 * ^{5}C_2$.
b) Once we have chosen 4 consonants and 2 vowels so we have totally 6 letters for arrangement to form words. The arrangement of these 6 can take place in 6! ways.

Quiz 2

1)Calculate 3!* $^{5}C_3$

A)40 B)50 C)60 D)70

2) a)In how many ways can 4 gifts be chosen out of 10 gifts?
A) 250 B) 260 C) 220 D)210

b) In how many ways can 4 gifts out of 10 be selected and distributed to 4 people?
A) 5040 B) 5010 C) 4096 D)9562

3) Suppose there are 8 consonants and 5 vowels. In how many ways can 4 consonants and 2 vowels be chosen out of these and arranged to form words ?
A) 234000 B)504000 C) 304000 D)124000

4) a)In how many ways can the letters of the word PLUNGE be arranged?
A) 256 B) 240 C) 720 D) 760

b)How many of these words start with L?
A) 120 B) 130 C) 140 D)150

5)
a)How many 4 digit numbers can be formed with the digits 2,3,4,5 if the repetition of the digits is not allowed?
A) B) C) D)24

b)How many 4 digit numbers can be formed using the digits 2,3,4,5 if any digit can be repeated any number of times.
A) 4^4 B) 24 C) 3^4 D) 34

3. Practical day to day applications

3.1 Pack of cards_tut_per_com:

Introduction:

A pack of card has in total 52 cards consisting of 13 cards of each suite . The suites are named as Diamonds, Spades, Hearts and Clubs. The cards are discussed in this chapter because a lot of selection and arrangement goes on in the game of cards and so doing some problems on it would improve the concepts on permutations.Note that among these 2 suits diamonds and hearts are red and the other 2 suits spades and clubs are black. Also there are in total 12 face cards i.e. 3 cards in each of the suite.

e.g. a) In how many ways can one select 10 cards in a game of cards.
b) In how many ways can the cards be distributed among 10 people so that everyone gets one card each.

Solution:
a) It is nothing but selecting 10 cards out of 52, so it can be done in = ${}^{52}C_{10}$ways.

b)Now once 10 cards have been selected it can be distributed to 10 people in 10 ! ways. This comes from the fact that the first card can be given in 10 ways , next in 9 ways , next in 8 ways and so on. So the total number of ways of selecting the cards and distributing is 10 ! * ${}^{52}C_{10}$ways which is nothing but ${}^{52}P_{10}$ ways.

e.g. In how many ways can 4 crads be chosen out of a pack of cards such that there are 2 red cards and 2 black crads.

Solution: There are 26 red cards and 26 black cards. We have to choose 2 red cards out of these 26 red cards and choose 2 black out of 26 black cards.So the answer should be ${}^{26}C_2 * {}^{26}C_2$.

Note:

The problems involving picking out balls from a bag are the same as those of cards as discussed above. We can understand this by an example

e.g. Suppose in a bag there are 26 different black balls and 26 different red balls.In how many ways can one pick 5 black balls and 4 red balls.

Solution: This is the same case as that of cards where we have 26 red cards and 26 black cards and then we make a choice. The answer will be nothing but choosing 5 black balls out of 26 different black balls and 4 red balls from 26 red balls.So ${}^{26}C_5 * {}^{26}C_4$

Note : Till now whenever we talked about selection we talked about different things and never about identical things. When all the balls are different then picking each ball gives a selection which is different. But when we talk about identical balls each pickup will give the same selection. So if there are 10 different balls in a bag then the number of ways of choosing one ball will be 10 ways. Each selection we will make will give a different selection of a ball. But when all the balls are identical then making a selection will give the same ball so the number of ways of selecting one ball out of 10 identical balls will be just one way.

e.g. Suppose that there are 5 identical red balls and 10 different black balls in a box.In how many ways can one choose 2 red balls and 5 black black balls.

Solution: Note that here we have 5 identical red balls and 10 different black balls.The number of ways of choosing 2 red balls out of the identical red balls is 1 and the number of ways of choosing 5 black balls out of 10 different black balls is ${}^{10}C_{5.}$

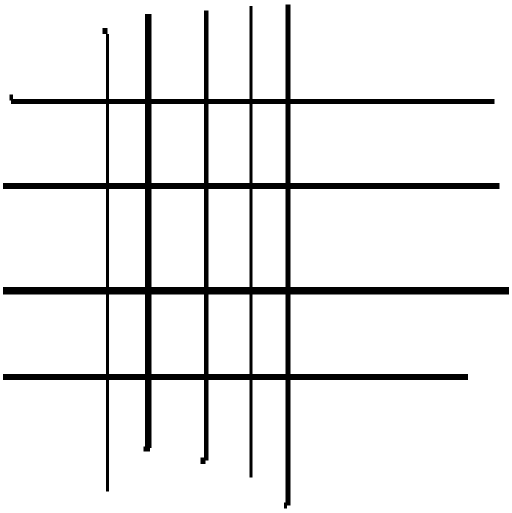
3.2 Geometry problems_tut_per_com:

Introduction:

The concept of permutations is used in a lot of geometrical problems. These geometrical problems can be easily solved using simple combinations. The trick lies in deciding what to choose and how to proceed. In this section we will deal with some elemntary problems in geometry using these concepts.

e.g If there are 5 points in a plane such that none of them are collinear[lying on the same straight line]`.
Solution: imagine how can one form a straight line, just by joining two points. So choosing any 2 points out of 5 points will give a straight line. So the problem essentially breaks into selecting 2 out of 5 which is nothing but ${}^{5}C_{2}$
Similarly we calculate the number of triangles and number of quardilaterals out of these 5 points for which we need to select 3 and 4 points respectively.

e.g. If there is a set of 5 parallel lines and another set of 4 parallel lines which are perpendicular to the initail set. Find the number of rectangles that can be formed?



It is again very simple , all that is needed is to imagine how a rectangle can be formed.It can be formed by any two parallel lines from one set and the other two lines from the other set. In simple terms if we choose any two line out of the set of 5 parallel lines and in simulataneously we choose 2 lines out of the other set of 4 parallel lines we get a rectangle. So the required number of rectangles is ${}^{5}C_{2}$* ${}^{4}C_{2}$= 10*6= 60 ways.

3.3 Tossing a coin_tut_per_com:

Introduction:

Tossing a coin can give only two outputs head(H) and tail(T).It is best to understand that a tossing of coin means doing a thing in two ways. The problems here are analogous to all the counting problems on digits that we have already done.It is like filling a place of a digit in two ways.

e.g. How many outputs will be there for a coin being tossed 3 times ?

Solution: It is same as filling 3 digits of a numbers where every digit can be filled in 2 ways. We know that a coin can give an output in 2 ways so the total number of outputs for the coin will be 2*2*2 = 8 ways.
We can also show these 8 outputs in the form of set { (HHT),(HHH),(HTH),(HTT)(TTT)(THT)(TTH)(THH)}

The same concept can be extended to throwing of dice. Like in a throwing of a dice we have two outcomes , we have 6 possible outcomes in throwing of dice.

e.g. How many outputs will be there if a dice is thrown 2 times?

Solution: It is the same as filling 2 digits of a number with the outcomes of a dice where every digit can be filled in 6 ways . So the total number of outcomes will be 6*6 = 36 ways. The 36 outcomes can be listed as follows {(1,1), (1,2), (1,3), (1,4),(1,5),(1,6)...(2,1),(2,2)....................(6,1),(6,2),6,3),(6,4),(6,5),(6,6)}

Quiz -3

1. In how many ways can 4 face cards be chosen out of a pack of cards?
A)500 B)495 C)505 D)510

2. In how many ways can 15 cards be chosen out of a pack of cards so that 10 are red and 5 are black?
A) $({}^{26}C_{10})$^2 B)56745 C) ${}^{26}C_{10}$ * ${}^{26}C_5$ D) 166670

3.Find the number of rectangles in a 8 by 8 chess board ?

A) 1450 B)1256 C)1200 D) 1296

4. Find the number of diagonals of a 7 sided heptagon ?
A) 14 B) 16 C)12 D) 11

5. Find the number of ways in 4 coins can be tossed so that the first coin always gives an output as head?
A) 16 B) 4 C) 2 D) 8

6.There are 5 identical pens and 6 identical rubbers and 4 different pencils.In how many ways can one pick these so as to have one of each.

A) 120 B) 30 C)36 D) 4

4. Solved problems

1.Find the number of 4 letter words, with or without meaning, which can be formed out of the letters of the word ROSE, where the repetition of the letters is not allowed.?

Solution:
The first place can be filled in 4 different ways by anyone of the 4 letters R,O,S,E. Following which, the second place can be filled in by anyone of the remaining 3 letters in 3 different ways, following which the third place can be filled in 2 different ways; following which, the fourth place can be filled in 1 way. Thus, the number of ways in which the 4 places can be filled, by the multiplication principle, is 4 × 3 × 2 × 1 = 24. Hence, the required number of words is 24.

2. A committee of 3 persons is to be constituted from a group of 2 men and 3 women. In how many ways can this be done? How many of these committees would consist of 1 man and 2 women?

Solution:
Here, order does not matter. Therefore, we need to count combinations.
There will be as many committees as there are combinations of 5 different persons taken 3 at a time. Hence, the required number of ways $^5C_3$=10 ways

×Now, 1 man can be selected from 2 men in 2C1 ways and 2 women can be selected from 3 women in 3C2 ways. Therefore, the required number of committee 2*3=6 ways.

3. There are 20 players and a team of 11 has to be formed?
Solution: The order of selection is not important.
If you picked the players as {P1, P2 , P3, P4, P5, P6, P9, P12, P15, P17, P20 }
or as
{P1, P20, P5, P6, P9, P17, P4, P12, P15, P3, P2 }, note that it is the same team that you have picked.
So you have to use N = nCm = 20C11 = 20! / (9! x 11!)

4.A photographer has to take a picture of a family consisting of 4 members - a father, a mother, a son and a daughter. In how many ways can he position the members to create a family photograph containing all the 4 members ? All the members should be in a single row.?

Solution:You can consider that there are 4 positions. Position 1, Position 2, Position 3, Position 4
Experiment : Different ways in which 4 objects can be arranged.
It can be conducted in 4 steps
Step 1 : Select a person for position 1 (M = 4 ways)
Step 2 : Select a person for position 2 (N = 3 ways)
Step 3 : Select a person for position 3 (O = 2 ways)
Step 4 : Select a person for position 4 (P = 1 way)
Total ways = M x N x O x P = 4 x 3 x 2 x 1
This is same as: 4P4 = 4! / (4-4)! = 4!
5. Calvin, Hobbes, Suzie and Rosalyn are pals planning to go for an outing in Calvin's

car.
All four can drive. The car is a standard model with 2 seats in the front (one being the
driver's seat) and two at the back.
1. In how many ways can they be seated in the car ?
2. In how many ways can they be seated in the car, if Hobbes does not want to drive ?
3. In how many ways can they be seated, if Calvin and Hobbes want to sit next to one another ?
4. In how many ways can they be seated, if Calvin and Suzie do not want to sit next to one another in the same row ?
5. If Rosalyn insists on driving, in how many ways can they be seated ?

Solution:
1. In how many ways can they be seated in the car ?
Experiment : Different ways in which 4 persons can be seated in 4 seats.
It can be conducted in 4 steps
Step 1 : Select a person for seat F1 (M = 4 ways, since all can drive)
Step 2 : Select a person for seat F2 (N = 3 ways)
Step 3 : Select a person for position B1 (O = 2 ways)
Step 4 : Select a person for seat B2 (P = 1 ways)
Total ways = M x N x O x P = 4 x 3 x 2 x 1
2. In how many ways can they be seated in the car, if Hobbes does not want to drive ?
Experiment : Different ways in which 4 persons can be seated in 4 seats if Hobbes does not
want to drive.
It can be conducted in 4 steps
Step 1 : Select a person for seat F1 (M = 3 ways, since all can drive, but Hobbes is not willing)
Step 2 : Select a person for seat F2 (N = 3 ways)
Step 3 : Select a person for position B1 (O = 2 ways)
Step 4 : Select a person for seat B2 (P = 1 ways)
Total ways = M x N x O x P = 3 x 3 x 2 x 1
3. In how many ways can they be seated, if Calvin and Hobbes want to sit next to one another ?
Experiment : Different ways in which 4 persons can be seated in 4 seats if Calvin and Hobbes want to sit next to one another.
It can be conducted in 3 steps
Step 1 : First allow Calvin and Hobbes to sit next to one another (M = 4 ways, since the two
can be seat either in front or back. Within that there are two ways. i.e.
Front : Calvin and Hobbes or Hobbes and Calvin
Back : Calvin and Hobbes or Hobbes and Calvin)
Step 2 : Select a person for the third seat (N = 2 ways. Reason, one Calvin and Hobbes occupy one row, you can choose between Suzie or Rosalyn for the 3rd seat)
Step 3 : Select a person for the last seat (O = 1 ways)
Total ways = M x N x O = 4 x 2 x 1
4. In how many ways can they be seated, if Calvin and Suzie do not want to sit next to one another ?
Experiment : Different ways in which 4 persons can be seated in 4 seats if Calvin and Suzie

do not want to sit next to one another in the same row.
It can be conducted in 4 steps
Step 1 : First seat Calvin (M = 4 ways, since he can be seated in any of the 4 seats)
Step 2 : Seat Suzie (N = 2 ways. Reason, once Calvin occupies a seat, Suzie cannot be seated in that row. She has to be seated in the other row. There are 2 seats from which she
can choose)
Step 3 : Select a person for the 3rd seat (O = 2 ways. You can choose between Hobbes and Rosalyn)
Step 4 : Select a person for the 4th seat (P = 1 ways. Only one is left, depending on whom
you select in step 3)
Total ways = M x N x O x P = 4 x 2 x 2 x 1
5. If Rosalyn insists on driving, in how many ways can they be seated ?
It can be conducted in 4 steps
Step 1 : First seat Rosalyn in the drivers seats (M = 1 way)
Step 2 : Select a person for seat F2 (N = 3 ways)
Step 3 : Select a person for position B1 (O = 2 ways)
Step 4 : Select a person for seat B2 (P = 1 way)
Total ways = M x N x O x P = 1 x 3 x 2 x 1

Review test

1. If ${}^{n}C_{4}$=146 then find the value of ${}^{n}P_{4}$?

A) 146 B) 146*2! C) 146*4! D)None of these

2. How many 5 lettered words can be formed out of 10 consonants and 4 vowels, such that each contains 3 consonants and 2 vowels?

A)650*5! B) 670*5! C) 720*5! D) 330*5!

3.How many motor vehicles numbers can be formed such that it has 5 digits, the first 2 being any of the english alphabets and other 3 being integers from 0-9 without repitition ?

A) 521000 B) 242000 C)212000 D) 468000

4.There are 10 points on a circle, how many distinct triangles can be formed using these points?

A)120 B) 360 C)200 D)240

5.A menu has 4 appetizers,7 main courses and 5 desserts. How many complete meals can be chosen from this menu?

A)140 B)150 C)160 D)170

6.
a) If there are 15 identical red balls, in how many ways can one choose 4 balls out of the lot?
A)1365 B)1 C)1400 D)4

b) If there are 15 different red balls in how many ways can one choose 4 balls out of the lot ?
A)1365 B)1 C)1400 D)4

c) There are 10 different red balls and 4 different green balls , in how many ways can one choose 2 red balls and 2 green balls out of the lot ?
A) 130 B) 240 C)270 D) 300

7. A basketball team consists of two forwards, two guards and a center. In how many ways can a coach choose a starting line up from 5 forwards,7 guards and 3 centers?
A)610 B)620 C)630 D)640

8. In how many ways can a hand of 6 clubs be chosen from a deck of cards?
A)1760 B) 1806 C)1860 D)1716

9.From a deck of cards, if 4 cards are drawn, in how many ways of these
a) Four cards are of the same suit?
A) 2860 B)2940 C)3100 D)2810

b)4 cards belong to different suits?
A) 28560 B) 28561 C) 28562 D)28563

c)4 cards are face cards?
A)500 B) 490 C)495 D) 510

d) 2 are red cards and 2 are black?
A) 105621 B) 105622 C)105623 D)105625

e) cards are of the same color ?
A) 29900 B) 29560 C)28880 D)21356

10) There are 5 contestants for a miss India pageant , in how many ways can one winner and a runner up be chosen ?
A)25 B)30 C)35 D)20

11) In how many can 5 persons line up to get into a bus ?
A)125 B)120 C) 138 D)140

12)There are 10 points in a plane out of which 3 points are collinear , how many straight lines can be drawn using these points ?
A)32 B) 36 C) 42 D) 45

$$^{2}C_{1} \times {}^{3}C_{2} = 6 \text{ ways}$$